

# Introduction to the Quantitative Analysis of Textual Data Using quanteda\*

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June 12, 2014

## 1 Introduction: The Rationale for quanteda

quanteda is an R package designed to simplify the process of quantitative analysis of text from start to finish, making it possible to turn texts into a structured corpus, convert this corpus into a quantitative matrix of features extracted from the texts, and to perform a variety of quantitative analyses on this matrix. The object is inference about the data contained in the texts, whether this means describing characteristics of the texts, inferring quantities of interests about the texts of their authors, or determining the tone or topics contained in the texts. The emphasis of quanteda is on *simplicity*: creating a corpus to manage texts and variables attached to these texts in a straightforward way, and providing powerful tools to extract features from this corpus that can be analyzed using quantitative techniques.

The tools for getting texts into a corpus object include:

- loading texts from directories of individual files
- loading texts “manually” by inserting them into a corpus using helper functions
- managing text encodings and conversions from source files into corpus texts
- attaching variables to each text that can be used for grouping, reorganizing a corpus, or simply recording additional information to supplement quantitative analyses with non-textual data
- recording meta-data about the sources and creation details for the corpus.

The tools for working with a corpus include:

- summarizing the corpus in terms of its language units
- reshaping the corpus into smaller units or more aggregated units
- adding to or extracting subsets of a corpus
- resampling texts of the corpus, for example for use in non-parametric bootstrapping of the texts (for an example, see Lowe and Benoit, 2013)

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\*This research was supported by the European Research Council grant ERC-2011-StG 283794-QUANTESS. Code contributors to the project include Alex Herzog, William Lowe, and Kohei Watanabe.

- Easy extraction and saving, as a new data frame or corpus, key words in context (KWIC)

For extracting features from a corpus, `quanteda` provides the following tools:

- extraction of word types
- extraction of word  $n$ -grams
- extraction of dictionary entries from user-defined dictionaries
- feature selection through
  - stemming
  - random selection
  - document frequency
  - word frequency
  - and a variety of options for cleaning word types, such as capitalization and rules for handling punctuation.

For analyzing the resulting *document-feature* matrix created when features are abstracted from a corpus, `quanteda` provides:

- scaling models, such as the Poisson scaling model or Wordscores
- nonparametric visualization, such as correspondence analysis
- topic models, such as LDA
- classifiers, such as Naive Bayes or  $k$ -nearest neighbour
- sentiment analysis, using dictionaries

`quanteda` is hardly unique in providing facilities for working with text – the excellent `tm` package already provides many of the features we have described. `quanteda` is designed to complement those packages, as well to simplify the implementation of the text-to-analysis workflow. `quanteda` corpus structures are simpler objects than in `tm`, as are the document-feature matrix objects from `quanteda`, compared to the sparse matrix implementation found in `tm`. However, there is no need to choose only one package, since we provide translator functions from one matrix or corpus object to the other in `quanteda`.

This vignette is designed to introduce you to `quanteda` as well as provide a tutorial overview of its features.

## 2 Installing `quanteda`

The code for the `quanteda` package currently resides on <http://github/kbenoit/quanteda>. From an Internet-connected computer, you can install the package directly using the `devtools` package:

```
library(devtools)
if (!require(quanteda)) install_github("quanteda", username="kbenoit")
```

For other branches, for instance if you wish to install the dev branch (containing work in progress) rather than the master, you should instead run

```
install_github("quanteda", username="kbenoit", ref="dev")
```

## 3 Creating a corpus

### 3.1 Loading Documents into Quanteda

#### From a directory of files

A very common source of files for creating a corpus will be a set of text files found on a local (or remote) directory. To load in a set of these files, we will load a corpus from a set of text files using information on attributes of the text that have been conveniently stored in the text document's filename (separated by underscores). For example, for our corpus of Irish budget speeches, the filename `2010_BUDGET_03_Joan_Burton_LAB.txt` tells us the year of the speech (2010), the type ("BUDGET"), a serial number (03), the first and last name of the speaker, and a party label ("LAB" for Labour).

To load this into a corpus object, we will use the `corpusFromFileNames` function, supplying a vector of attribute labels that correspond with the elements of the filename.

```
library(quanteda)
tmpDir <- tempdir() # create a temporary directory for example files
textfile <- "https://github.com/kbenoit/quanteda/blob/dev/texts/irishbudgets2010.zip?raw=true"
download.file(textfile, paste(tmpDir, "irishbudgets2010.zip", sep="/"),
              method="curl", extra="-L") # download this zipped archive of texts
# unzip the file to the temporary folder
unzip(paste(tmpDir, "irishbudgets2010.zip", sep="/"), exdir=tmpDir)
# list the files unzipped
list.files(paste(tmpDir, "budget_2010", sep="/"))

## [1] "2010_BUDGET_01_Brian_Lenihan_FF.txt"
## [2] "2010_BUDGET_02_Richard_Bruton_FG.txt"
## [3] "2010_BUDGET_03_Joan_Burton_LAB.txt"
## [4] "2010_BUDGET_04_Arthur_Morgan_SF.txt"
## [5] "2010_BUDGET_05_Brian_Cowen_FF.txt"
## [6] "2010_BUDGET_06_Enda_Kenny_FG.txt"
## [7] "2010_BUDGET_07_Kieran_ODonnell_FG.txt"
## [8] "2010_BUDGET_08_Eamon_Gilmore_LAB.txt"
## [9] "2010_BUDGET_09_Michael_Higgins_LAB.txt"
## [10] "2010_BUDGET_10_Ruairi_Quinn_LAB.txt"
## [11] "2010_BUDGET_11_John_Gormley_Green.txt"
## [12] "2010_BUDGET_12_Eamon_Ryan_Green.txt"
## [13] "2010_BUDGET_13_Ciaran_Cuffe_Green.txt"
## [14] "2010_BUDGET_14_Caoimhghin_OCaolain_SF.txt"

# create a corpus from the files, parsing the filenames
ieBudgets2010 <- corpusFromFileNames(paste(tmpDir, "budget_2010", sep="/"),
                                     c("year", "debate", "number", "firstname", "lastname", "party"),
                                     sep="_")
```

This creates a new quanteda corpus object where each text has been associated values for its attribute types extracted from the filename:

```
summary(ieBudgets2010)

## Corpus object contains 14 texts.
##
##
##           Texts Types Tokens Sentences year debate
## 2010_BUDGET_01_Brian_Lenihan_FF.txt 1655 7799      390 2010 BUDGET
## 2010_BUDGET_02_Richard_Bruton_FG.txt  956 4058      222 2010 BUDGET
## 2010_BUDGET_03_Joan_Burton_LAB.txt 1485 5770      329 2010 BUDGET
## 2010_BUDGET_04_Arthur_Morgan_SF.txt 1463 6481      349 2010 BUDGET
## 2010_BUDGET_05_Brian_Cowen_FF.txt 1473 5880      262 2010 BUDGET
## 2010_BUDGET_06_Enda_Kenny_FG.txt 1066 3875      161 2010 BUDGET
## 2010_BUDGET_07_Kieran_ODonnell_FG.txt 614 2066      141 2010 BUDGET
## 2010_BUDGET_08_Eamon_Gilmore_LAB.txt 1098 3800      208 2010 BUDGET
## 2010_BUDGET_09_Michael_Higgins_LAB.txt 447 1136       49 2010 BUDGET
## 2010_BUDGET_10_Ruairi_Quinn_LAB.txt 418 1177       60 2010 BUDGET
## 2010_BUDGET_11_John_Gormley_Green.txt 363  929       49 2010 BUDGET
## 2010_BUDGET_12_Eamon_Ryan_Green.txt 482 1513       90 2010 BUDGET
## 2010_BUDGET_13_Ciaran_Cuffe_Green.txt 423 1143       48 2010 BUDGET
## 2010_BUDGET_14_Caoimhghin_OCaolain_SF.txt 1055 3654      194 2010 BUDGET
## number  firstname lastname party
## 14 Caoimhghin OCaolain  SF
## 13  Ciaran      Cuffe    Green
## 12  Eamon      Ryan     Green
## 11  John       Gormley   Green
## 10  Ruairi     Quinn    LAB
## 09  Michael    Higgins   LAB
## 08  Eamon      Gilmore   LAB
## 07  Kieran     ODonnell  FG
## 06  Enda       Kenny     FG
## 05  Brian      Cowen     FF
## 04  Arthur     Morgan    SF
## 03  Joan       Burton    LAB
## 02  Richard    Bruton    FG
## 01  Brian      Lenihan   FF
##
## Source: /home/paul/Dropbox/code/quanteda/vignettes/* on x86_64 by paul.
## Created: Thu Jun 12 19:09:46 2014.
## Notes: NA.
```

## From a vector of texts

```
# load two vectors of texts (Bollinger texts from Evans et al JELS 2007)
# located in the texts directory of the github site
amicusFile <- "https://github.com/kbenoit/quanteda/blob/dev/texts/amicus_curiae.zip?raw=true"
tmpDir <- tempdir()
download.file(amicusFile, paste(tmpDir, "amicus_curiae.zip", sep="/"),
              method="curl", extra="-L") # download this zipped archive of texts
# unzip the file to the temporary folder
unzip(paste(tmpDir, "amicus_curiae.zip", sep="/"), exdir=tmpDir)

# load in the texts to a vector of texts using quanteda's getTextDir()
amicusTexts <- c(getTextDir(paste(tmpDir, "amicus/training", sep="/")),
```

```

    getTextDir(paste(tmpDir, "amicus/testing", sep="/"))
# change the encoding (because texts contain special symbols such as $)
amicusTexts <- iconv(amicusTexts, from="latin1", to="UTF-8")

# examine the amicusTexts object - a named character vector where the
# names of the elements are the original text filename
str(amicusTexts)

## Named chr [1:100] "In granting a strong preference in admissions to applicants from a select group of racial and e
## - attr(*, "names")= chr [1:100] "sP1P2.txt" "sR1R2.txt" "sAP01.txt" "sAP02.txt" ...

# set training class - Petitioner or Respondent, only known for the two test docs
trainclass <- factor(c("P", "R", rep(NA, length(amicusTexts)-2)))

# set test class, an attribute that could be used in classification
# here we take these from the text filenames, where
# 'AP' means Amicus brief for Petitioner
# 'AR' means Amicus brief for Respondent
testclass <- rep(NA, length(amicusTexts)) # initialize the variable
testclass[grep("AP", names(amicusTexts))] <- "AP"
testclass[grep("AR", names(amicusTexts))] <- "AR"

# make a corpus object with texts and training and test labels
amicusCorpus <-
  corpusCreate(amicusTexts,
    attribs = list(trainclass=trainclass, testclass=testclass),
    source = "Bollinger texts from Evans et al JELS 2007",
    notes = "Created as part of the quanteda vignette")
# summarize the first 10 texts in the corpus
summary(amicusCorpus, nmax=10)

## Corpus object contains 100 texts.
##
##      Texts Types Tokens Sentences trainclass testclass
## sP1P2.txt  2893  22907      2221         P      <NA>
## sR1R2.txt  3918  23970      1900         R      <NA>
## sAP01.txt  1479   6181       435      <NA>       AP
## sAP02.txt  1671   6232       644      <NA>       AP
## sAP03.txt  1740   7726       696      <NA>       AP
## sAP04.txt  1128   4725       431      <NA>       AP
## sAP05.txt  1800   7005       583      <NA>       AP
## sAP06.txt  1288   4852       381      <NA>       AP
## sAP07.txt  1249   4914       330      <NA>       AP
## sAP08.txt   620   1748       110      <NA>       AP
##
## Source:  Bollinger texts from Evans et al JELS 2007.
## Created: Thu Jun 12 19:09:51 2014.
## Notes:   Created as part of the quanteda vignette.

```

## **3.2 Adding Information to a corpus**

Adding new texts

Adding new text attributes

## **3.3 Translating a quantedacorporus into other formats**

Importing from QDAMiner

Importing to and exporting from tm

## **4 Manipulating a corpus**

## **5 Extracting Features**

## **6 Analyzing a document-feature matrix**

## **References**

Lowe, William and Kenneth Benoit. 2013. "Validating Estimates of Latent Traits From Textual Data Using Human Judgment as a Benchmark." *Political Analysis* 21(3):298–313.